

Exercise 1.1 — The sample space

- Q1** a) There is 1 outcome corresponding to the 7 of diamonds, and 52 outcomes in total.
So $P(7 \text{ of diamonds}) = \frac{1}{52}$
- b) There is 1 outcome corresponding to the queen of spades, and 52 outcomes in total.
So $P(\text{queen of spades}) = \frac{1}{52}$
- c) There are 4 outcomes corresponding to a '9', and 52 outcomes in total. So $P(9 \text{ of any suit}) = \frac{4}{52} = \frac{1}{13}$
- d) There are 26 outcomes corresponding to a heart or a diamond, and 52 outcomes in total.
So $P(\text{heart or diamond}) = \frac{26}{52} = \frac{1}{2}$

- Q2** a) 6 of the 36 outcomes are prime numbers.
So $P(\text{product is a prime number}) = \frac{6}{36} = \frac{1}{6}$
- b) 14 of the 36 outcomes are less than 7.
So $P(\text{product is less than 7}) = \frac{14}{36} = \frac{7}{18}$
- c) 6 of the 36 outcomes are multiples of 10.
So $P(\text{product is a multiple of 10}) = \frac{6}{36} = \frac{1}{6}$

- Q3** a) E.g.
- | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|----|
| T | • | • | • | • | • | • | • | • | • | • |
| H | • | • | • | • | • | • | • | • | • | • |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

- b) There are 5 ways of getting an even number and 'tails', and 20 outcomes altogether.
So $P(\text{even number and tails}) = \frac{5}{20} = \frac{1}{4}$

- Q4** a) E.g.
- | | | | | | | |
|---|---|---|---|---|---|---|
| – | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 0 | 1 | 2 | 3 | 4 | 5 |
| 2 | 1 | 0 | 1 | 2 | 3 | 4 |
| 3 | 2 | 1 | 0 | 1 | 2 | 3 |
| 4 | 3 | 2 | 1 | 0 | 1 | 2 |
| 5 | 4 | 3 | 2 | 1 | 0 | 1 |
| 6 | 5 | 4 | 3 | 2 | 1 | 0 |

b) 6 of the 36 outcomes are zero.

$$\text{So } P(\text{score is zero}) = \frac{6}{36} = \frac{1}{6}$$

c) None of the outcomes are greater than 5.

$$\text{So } P(\text{score is greater than 5}) = 0$$

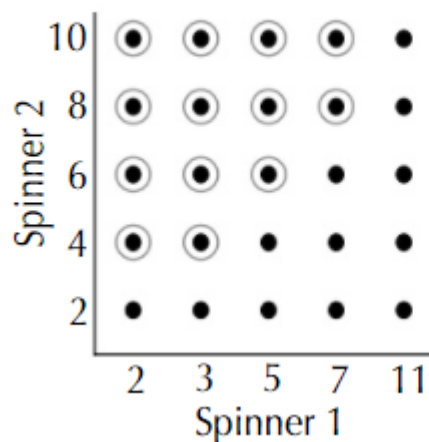
d) The most likely score is the one corresponding to the most outcomes — so it's 1.

10 of the 36 outcomes give a score of 1, so:

$$P(1) = \frac{10}{36} = \frac{5}{18}$$

Q5 Start by drawing a sample-space diagram to show all the possible outcomes for the two spins combined. Then circle the ones that correspond to the event 'number on spinner 2 is greater than number on spinner 1'.

E.g.

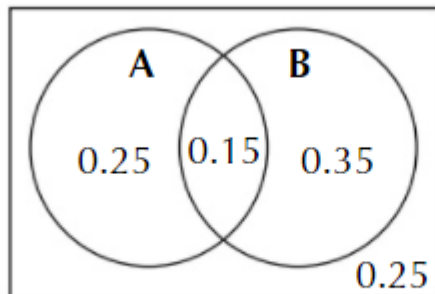


There are 13 outcomes that correspond to the event 'number on spinner 2 is greater than number on spinner 1', and 25 outcomes altogether.

$$\text{So } P(\text{spinner 2} > \text{spinner 1}) = \frac{13}{25}$$

Exercise 2.1 — Venn diagrams and two-way tables

- Q1** a) Label the diagram by starting in the middle with the probability for A and B. Then subtract this probability from $P(A)$ and $P(B)$. And remember to find $P(\text{neither A nor B})$ by subtracting the other probabilities from 1.
So:



- b) $P(\text{neither A nor B}) = 0.25$

- Q2** a) Use the totals to fill in the gaps:

$$\text{No coffee/BC Tops} = 0.51 - 0.16 - 0.11 = 0.24$$

$$\text{'No coffee' total} = 0.24 + 0.12 + 0.14 = 0.50$$

$$\text{'Nenco' total} = 1 - 0.18 - 0.50 = 0.32$$

$$\text{Nenco/No tea} = 0.32 - 0.16 - 0.07 = 0.09$$

$$\text{'Cumbria' total} = 1 - 0.51 - 0.27 = 0.22$$

$$\text{Yescafé/No tea} = 0.27 - 0.09 - 0.14 = 0.04$$

$$\text{Yescafé/Cumbria} = 0.22 - 0.07 - 0.12 = 0.03$$

	BC Tops	Cumbria	No tea	Total
Nenco	0.16	0.07	0.09	0.32
Yescafé	0.11	0.03	0.04	0.18
No coffee	0.24	0.12	0.14	0.50
Total	0.51	0.22	0.27	1

- b) (i) $P(\text{Cumbria and Yescafé}) = 0.03$

- (ii) $P(\text{Coffee}) = 1 - P(\text{No coffee}) = 1 - 0.50 = 0.50$

You could also find this by adding up the totals for the two brands of coffee: $P(\text{Coffee}) =$

$$P(\text{Nenco}) + P(\text{Yescafé}) = 0.32 + 0.18 = 0.50$$

- (iii) $P(\text{tea but no coffee}) = P(\text{BC Tops and no coffee}) + P(\text{Cumbria and no coffee}) = 0.24 + 0.12 = 0.36$

Another way to find this is $P(\text{No coffee}) -$

$$P(\text{No coffee and no tea}) = 0.50 - 0.14 = 0.36 \quad \underline{\hspace{1cm}}$$

- Q3** a) Let M be 'studies maths' and P be 'studies physics'. The total number of students is 144, so that goes in the bottom right-hand corner. You can also fill in the totals for the P row and the M column — these are the total number of students studying each subject. You also know the number that study both:

	M	not M	Total
P	19		38
not P			
Total	46		144

Now you can work out all the missing values:

	M	not M	Total
P	19	$38 - 19 = 19$	38
not P	$46 - 19 = 27$	$98 - 19 = 79$	$144 - 38 = 106$
Total	46	$144 - 46 = 98$	144

- b) M or P has $19 + 27 + 19 = 65$ outcomes.
 So $P(M \text{ or } P) = \frac{65}{144}$
- c) So you're only interested in the 46 students who study maths. 19 students study maths and physics, so $P(\text{maths student also studies physics}) = \frac{19}{46}$.

Q4 a) $P(L \text{ and } M) = 0.1$

b) $P(L \text{ and } N) = 0$

c) $P(N \text{ and not } L) = 0.25$

Since N doesn't overlap with L, N and not L is just N.

d) $P(\text{neither } L \text{ nor } M \text{ nor } N)$

$$= 1 - (0.25 + 0.1 + 0.15 + 0.25) = 0.25$$

e) $P(L \text{ or } M) = 0.25 + 0.1 + 0.15 = 0.5$

f) $P(\text{not } M) = 0.25 + 0.25 + 0.25 = 0.75$

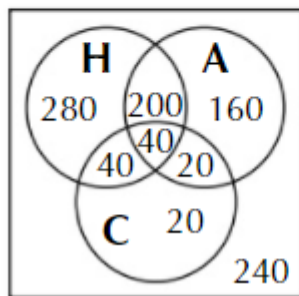
Don't forget to include P(neither L nor M nor N).

You could also find P(not M) by doing $1 - P(M)$

$$= 1 - (0.1 + 0.15).$$

- Q5** a) Number of outcomes not in S or F or G
 $= 200 - (17 + 18 + 49 + 28 + 11 + 34 + 6) = 37$
 So $P(\text{not in S or F or G}) = \frac{37}{200}$
- b) You're only interested in those people who have been to France — $49 + 28 + 34 + 11 = 122$ people.
 The number of people who have been to France **and** Germany $= 28 + 34 = 62$.
 So $P(G, \text{ given } F) = \frac{62}{122} = \frac{31}{61}$
- c) Number of outcomes in S and not F $= 17 + 18 = 35$.
 So $P(S \text{ and not } F) = \frac{35}{200} = \frac{7}{40}$

- Q6** a) Start by drawing a Venn diagram to represent the information. If H = 'goes to home league matches', A = 'goes to away league matches' and C = 'goes to cup matches', then:



The people who go to exactly 2 types of match are those in (H and A and not C), (H and C and not A), and (A and C and not H).

That's $200 + 40 + 20 = 260$ people.

So $P(2 \text{ types of match}) = \frac{260}{1000} = \frac{13}{50}$

- b) $P(\text{at least 1 type of match}) = 1 - P(\text{no matches})$
 $= 1 - \frac{240}{1000} = \frac{760}{1000} = \frac{19}{25}$